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Psychosocial work characteristics as risk factors for the onset of fatigue and psychological distress: prospective results from the Maastricht Cohort Study

U. BÜLTMANN,¹ IJ. KANT, P. A. VAN DEN BRANDT AND S. V. KASL

From the Department of Epidemiology, Maastricht University, Maastricht, The Netherlands; and Department of Epidemiology and Public Health, Yale University School of Medicine, New Haven, CT, USA

ABSTRACT

Background. Prolonged fatigue has recently attracted attention in occupational (mental) health research since it may lead to sickness absenteeism and work disability. To date, little is known about the role of psychosocial work characteristics in the aetiology of fatigue. In this study we examined prospectively a wide range of psychosocial work characteristics as possible risk factors for the onset of fatigue and psychological distress in the working population.

Methods. This study is based on 8833 employees, participating in the Maastricht Cohort Study of 'Fatigue at Work'. A wide range of psychosocial work characteristics, measured at baseline, was used to predict the onset of fatigue and psychological distress 1 year later. Fatigue was measured with the Checklist Individual Strength; the General Health Questionnaire was used to measure psychological distress.

Results. The cumulative incidence of fatigue during 1 year follow-up was 9.7% ($N = 492$) in men, and 13.5% ($N = 241$) in women. Psychological demands at work as well as physical and emotional demands increased the risk for fatigue in men, whereas decision latitude in men and co-worker social support in women were protective against fatigue. These prospective associations remained significant after adjustments for potential confounders and baseline fatigue. As regards psychological distress, no association was found with decision latitude, while conflicts at work increased the risk of psychological distress.

Conclusions. Psychosocial work characteristics were significant predictors for the onset of fatigue in the working population. The prospective associations suggest some differential effects in the aetiology of fatigue and psychological distress. Good interpersonal relationships at work and high decision authority were demonstrated to be relevant aspects that should be targeted for prevention.

INTRODUCTION

Fatigue is a common symptom of ill-health (Chen, 1986; Pawlikowska *et al.* 1994; Hickie *et al.* 1996; Loge *et al.* 1998). Fatigue that becomes prolonged is reported to be associated with impairments comparable to chronic medical conditions (Kroenke *et al.* 1988) and may

interfere with an individual's performance and functioning in the occupational as well as in the home setting. In recent years, prolonged fatigue has attracted attention in occupational (mental) health research, since it may lead to sickness absenteeism and work disability (Schröer, 1997). As pointed out by Houtman (1999), about one in every three work disability benefit recipients in the Netherlands is classified as disabled for work on mental grounds. Given the unfavourable prognosis of prolonged fatigue and the high cost implications for employers, employees and

¹ Address for correspondence: Dr Ute Bültmann, Department of Epidemiology, Maastricht University, PO Box 616, 6200 MD Maastricht, The Netherlands.

society (Schröer, 1997), there is an urgent need for preventive measures.

Recently, the large-scale epidemiological Maastricht Cohort Study of 'Fatigue at Work' has shown that fatigue is a common complaint in the working population: 22% of the 12000 employees reported fatigue (Bültmann *et al.* 2002a). For the development of preventive measures for sickness absenteeism and work disability due to fatigue, it is important to identify the risk factors for the onset of fatigue. While the likely multi-factorial aetiology of fatigue is stressed in the literature (Lewis & Wessely, 1992) and 'psychosocial' (e.g. work, family and lifestyle) is the commonest mentioned reason for feeling fatigued (Pawlikowska *et al.* 1994), there is very little information about psychosocial work characteristics which predict fatigue.

At present, we do know from a cross-sectional study among specific occupational groups in the workforce of the UK National Health Service Trusts (Hardy *et al.* 1997) that high work demands and role conflict are related to high levels of fatigue. Moreover, cross-sectional analyses of the baseline data of the Maastricht Cohort Study revealed relationships between psychosocial work characteristics (e.g. low decision latitude, low social support at work, high emotional demands) on the one hand, and fatigue on the other (Bültmann *et al.* 2002b). The same study found that fatigue and psychological distress are fairly well associated in the working population ($r = 0.62$), and that about 23% of the 12000 employees were considered to be probable cases of psychological distress (Bültmann *et al.* 2002a).

To disentangle which psychosocial work characteristics play a role in the onset of fatigue and psychological distress, prospective longitudinal analyses are invaluable. Previous longitudinal studies such as the Whitehall II cohort of British civil servants (Stansfeld *et al.* 1997, 1999) and the Gazel cohort in France (Niedhammer *et al.* 1998) accumulated evidence for a relationship between psychosocial work characteristics and psychiatric disorder or depressive symptoms, respectively. Although their operationalization of psychosocial work characteristics and the occupational settings differ, these studies showed that low social support at work, high psychological demands, and low decision latitude

(decision authority) were predictors of psychiatric disorder and depressive symptoms. As regards to fatigue, however, such prospective associations are not yet established. Moreover, the role of emotional and physical demands, job insecurity, and conflicts with supervisor/co-worker as possible determinants of fatigue and psychological distress in the working population has rarely been examined.

In the present study we explored prospectively a wide range of psychosocial work characteristics as possible risk factors for fatigue and psychological distress in the working population, thereby comparing associations for fatigue and psychological distress. We examined this through the Maastricht Cohort Study, a large-scale prospective study of 'Fatigue at Work'. The longitudinal relations between psychosocial work characteristics, measured at baseline, and (the incidence of) fatigue and psychological distress at follow-up 1 year later, were examined using linear regression analysis and logistic regression analysis. Both analyses controlled for potential sociodemographic confounding variables and for either fatigue or psychological distress, depending on the outcome assessed. Given the observed difference between men and women as regards to psychological distress, all analyses were conducted separately for men and women.

METHOD

Sampling and procedures

The present report is based on the Maastricht Cohort Study of 'Fatigue at Work', a large-scale prospective study of the onset and natural history of fatigue and psychological distress in the working population (Bültmann *et al.* 2000; Kant *et al.* 2000). In May 1998, 26978 employees aged 18–65 years from 45 companies and organizations received a letter at home, inviting participation, and the self-administered baseline questionnaire, which included items on psychosocial work characteristics, demographic, work-family and health factors as well as on fatigue and psychological distress. A total of 12161 employees completed and returned the baseline questionnaire (response rate of 45%). Written consent was obtained from all participants. Sixty-six questionnaires were excluded from the analysis because the age criterion was not met

and due to technical reasons. The baseline cohort consists of 8840 men (73%) and 3255 women (27%).

A non-response analysis revealed no significant differences between respondents and non-respondents with respect to demographic characteristics. Non-respondents were less likely to report fatigue complaints (42% *v.* 55%, $\chi^2 = 11.1$, $P < 0.05$), sickness absence (21% *v.* 39%, $\chi^2 = 21.5$, $P < 0.05$), and difficulties in work execution due to health complaints (17% *v.* 26%, $\chi^2 = 7.75$, $P < 0.05$). The main reason for non-response was 'no time to complete the questionnaire' (30%), followed by 'nothing would be done with the results' (18%), and 'no interest in the study subject' (15%). Full details of the sampling and the baseline characteristics of the study population have been reported elsewhere (Bültmann *et al.* 2002a).

In May 1999, those employees ($N = 11272$) who had completed the baseline questionnaire and at least one of the two short questionnaires, which were sent in September 1998 and January 1999, were approached again to complete the follow-up questionnaire. Overall, 9625 employees, 7025 men (73%) and 2600 women (27%), completed and returned the follow-up questionnaire (response rate of 80%). In the present analysis, we excluded those employees who reported themselves at baseline absent from work or reported working under modified conditions related to former sickness absence (e.g. fewer hours, modified tasks or other functions). Therefore, the final study population on whom follow-up data were available was 8833 employees, 6522 men (74%) and 2311 women (26%).

Measurements

Psychosocial work characteristics

All information on psychosocial work characteristics used in this study was obtained from the baseline questionnaire. A validated Dutch version of the Job Content Questionnaire (JCQ) was used to measure psychological demands, decision latitude and social support at work (Karasek, 1985; Houtman, 1995). Psychological demands are assessed by the sum of five items (excessive work, conflicting demands, insufficient time to do work, work fast and work hard). Decision latitude is measured by the sum of two subscales: skill discretion (keep learning new

things, can develop skills, job requires skills, task variety, work not repetitious, job requires creativity) and decision authority (have freedom to make decisions, can choose how to perform work, and have a lot to say on the job). Social support is assessed by two scales, each consisting of four items: supervisor support (concerned about the welfare of those under him/her, pays attention, helpful in getting the job done, successful in getting people to work together) and co-worker support (they take a personal interest in me, are friendly, helpful in getting the job done, and competent in doing work). For each item the response options varied on a four-point scale from 'strongly disagree' to 'strongly agree'. In the logistic regression analysis, the total scores for psychological demands and decision latitude were grouped into tertiles, for both support measures the total score was dichotomized at the median.

Emotional demands at work are measured by the sum of five items (confronted with personally upsetting things, personal attacked or threatened, getting annoyed about others, moving work situations, and one or more shocking events at work during last year e.g. accident, violent crime, sexual harassment, aggression at work). The questions were derived from a Dutch questionnaire on Work and Health (Gründemann *et al.* 1993), a Dutch questionnaire on Perception and Judgement of Work (Van Veldhoven & Meijman, 1994), and self-formulated (item on shocking events at work). The response option for each item was yes/no. In the present study, emotional demands at work was indicated as no emotional demands (score = 0), low emotional demands (score = 1), and high emotional demands (score = 2–5).

To assess whether employees perceive their work as physically demanding (yes/no), one item from the Dutch questionnaire on Work and Health (Gründemann *et al.* 1993) was used. Three items from the Dutch questionnaire on Perception and Judgement of Work (Van Veldhoven & Meijman, 1994) were used to measure job insecurity (yes/no), conflicts with supervisor (yes/no) and conflicts with co-workers (yes/no).

Demographic and health factors

At baseline employees provided information on age, educational level, living alone (yes/no),

status of employment (permanent contract or temporary contract) and the presence of disease (yes/no), comprising for example chronic low back pain, rheumatoid arthritis and hypertension. Details of these measures, which are considered in the analyses as confounding factors, have been reported elsewhere (Bültmann *et al.* 2002a).

Fatigue

The 20-item self-report Checklist Individual Strength (CIS), which was originally developed for hospital studies of chronic fatigue syndrome, was used to measure fatigue (Vercoulen *et al.* 1994, 1999). The CIS covers several aspects of fatigue, such as severity, concentration, motivation and physical activity level, which fit in with the concept of fatigue. The instrument was extensively tested in the clinical setting (Vercoulen *et al.* 1996a, b) and was validated in the working population (Beurskens *et al.* 2000). Subjects are instructed to indicate how they felt during the last 2 weeks. The response to each statement is scored on a 7-point Likert scale (1 = Yes, that is true; to, 7 = No, that is not true). Higher scores indicate a higher degree of fatigue, more concentration problems, reduced motivation or low levels of activity. In the Maastricht Cohort Study, the responses to the individual items were summed to generate a CIS-total score, ranging from 20–140. The cut-off point for case classification used in the present study was CIS-total > 76. This cut-off was established in a separate pilot study by means of defined samples with differences in fatigue levels (Bültmann *et al.* 2000). All those employees scoring > 76 on the CIS were considered to report a level of fatigue indicative of being 'at risk' for sickness absence or work disability, and were designated as probable fatigue cases.

Psychological distress

The 12-item version of the General Health Questionnaire (GHQ-12) was used to assess psychological distress (Goldberg & Williams 1988; Koeter & Ormel 1991). The GHQ-12 was developed as a screening instrument for detecting minor psychiatric disorders in the general population. Two scoring systems were used for the four-point response scale. The Likert scoring method (0, 1, 2, 3) summed the responses of the

12 items to generate a continuous distribution, ranging from 0–36. The traditional GHQ scoring method (0, 0, 1, 1) is designed to identify individuals reporting sufficient psychological distress to be classified as probable cases of minor psychiatric disorder. In the present study, the threshold for case classification was ≥ 4 , given a possible range of scores from 0–12. That means, employees scoring on ≥ 4 of the 12 items were considered to be probable cases of psychological distress. The threshold for case classification is high, but identical to the threshold used in previous workplace studies (Hardy *et al.* 1997; Wall *et al.* 1997), permitting direct comparison of the results, and likely to indicate very symptomatic employees as probable cases of minor psychiatric disorder.

Data analysis

All analyses were performed separately for men and women because of the observed gender difference regarding psychological distress (Bültmann *et al.* 2002a). Pearson intercorrelations were calculated for the psychosocial work characteristics and the cumulative incidence of fatigue and psychological distress during 1-year follow-up period was determined. To examine the role of psychosocial work characteristics, measured at baseline, in the onset of fatigue and psychological distress after 1-year follow-up, the data were analysed using two methods. The primary analysis was linear regression analysis, which makes no assumptions about a diagnostic cut-off point and therefore fully reflects the continuous nature of the dependent measures. In addition, logistic regression analysis with dichotomized dependent measures was used. Data were analysed using SPSS 9.0 (SPSS, 1998).

Multiple linear regression analysis was used to examine the effect of each psychosocial work characteristic separately on changes in fatigue and psychological distress 1 year later. Additionally, given there are intercorrelations among the psychosocial work characteristics, the predictive effects of psychosocial work characteristics for future fatigue and psychological distress were examined by entering them all together, rather than one at a time. Adjustments for potential confounding variables were made in three steps: covariates age; educational

Table 1. Correlation matrix of psychosocial work characteristics for men (bold type face, N = 6522) and women (N = 2311)

	1	2	3	4	5	6	7	8	9
1 Psychological job demands		0.03*	-0.20**	-0.05**	0.26**	0.18**	0.15**	0.07**	0.05**
2 Decision latitude	0.06**		0.35**	0.23**	-0.14**	-0.32**	-0.15**	-0.05**	-0.15**
3 Supervisor social support	-0.18**	0.29**		0.24**	-0.24**	-0.16**	-0.37**	-0.10**	-0.17**
4 Co-worker social support	-0.09**	0.16**	0.30**		-0.17**	-0.07**	-0.07**	-0.24**	-0.12**
5 Emotional demands	0.24**	-0.02	-0.15**	-0.09**		0.26**	0.29**	0.26**	0.19**
6 Physical demands	0.19**	-0.12**	-0.02	0.01	0.31**		0.11**	0.06**	0.08**
7 Conflicts supervisor	0.14**	-0.11**	-0.31**	-0.06**	0.20**	0.04		0.24**	0.09**
8 Conflicts co-worker	0.11**	-0.07**	-0.14**	-0.19**	0.18**	0.03	0.26**		0.09**
9 Job insecurity	0.03	-0.13**	-0.14**	-0.07**	0.07**	-0.02	0.07**	0.03	

Correlation significant at: * $P < 0.05$; ** $P < 0.01$.

Table 2. Work characteristics at baseline predict fatigue after 1-year follow-up in men and women, adjusted for potential confounders and baseline measures

Work characteristic	Men (N = 6522)					
	Model 1†		Model 2‡		Model 3§	
	B	S.E.	B	S.E.	B	S.E.
Psychological demands	0.632***	0.052	0.184***	0.037	0.140***	0.038
Decision latitude	-0.493***	0.027	-0.103***	0.020	-0.094***	0.020
Supervisor support	-1.529***	0.128	-0.093	0.093	0.0008	0.093
Co-worker support	-1.589***	0.188	-0.135	0.135	-0.088	0.135
Physical demands	8.159***	0.784	2.213***	0.563	1.958**	0.564
Emotional demands	4.016***	0.236	0.882***	0.175	0.624***	0.179
Job insecurity	7.488***	1.129	-0.939	0.807	-1.658*	0.809
Conflicts supervisor	8.712***	0.975	1.012	0.698	0.404	0.701
Conflicts co-worker	6.737***	1.117	1.548	0.791	0.941	0.793

Work characteristic	Women (N = 2311)					
	B	S.E.	B	S.E.	B	S.E.
	Psychological demands	0.427***	0.095	-0.007	0.080	-0.011
Decision latitude	-0.313***	0.051	-0.073	0.043	-0.071	0.044
Supervisor support	-1.539***	0.233	-0.222	0.200	-0.215	0.203
Co-worker support	-2.226***	0.330	-1.112***	0.279	-1.105***	0.281
Physical demands	3.967**	1.250	1.881	1.042	1.801	1.049
Emotional demands	1.924***	0.422	0.274	0.358	0.243	0.364
Job insecurity	6.326**	1.967	1.202	1.642	1.113	1.652
Conflicts supervisor	8.377***	2.123	2.062	1.787	1.973	1.823
Conflicts co-worker	9.015***	2.243	2.759	1.888	2.795	1.904

† Adjusted for age, educational level, living alone, employment status and presence of disease.

‡ Adjusted for age, educational level, living alone, employment status, presence of disease and baseline CIS score (continuous).

§ Adjusted for age, educational level, living alone, employment status, presence of disease, baseline CIS score (continuous) and baseline GHQ score (continuous).

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

level; living alone; employment status; and, presence of disease were entered at the first step. At the second step, we also controlled for the continuous baseline values of the dependent measure. Finally, since fatigue and psychological distress are fairly well associated, we adjusted for the continuous baseline value of GHQ-12 or CIS score, when fatigue or psychological distress

was considered as dependent variable, respectively. Unstandardized regression coefficients (B) and their standard errors (S.E. B) were determined for each model.

Multiple logistic regression was conducted in two steps for each psychosocial work characteristic separately. Either fatigue or psychological distress cases at baseline were excluded.

Table 3. *Work characteristics at baseline predict psychological distress after 1-year follow-up in men and women, adjusted for potential confounders and baseline measures*

Work characteristic	Men (<i>N</i> = 6522)					
	Model 1†		Model 2‡		Model 3§	
	B	S.E.	B	S.E.	B	S.E.
Psychological demands	0.158***	0.011	0.068***	0.010	0.064***	0.010
Decision latitude	-0.063***	0.006	-0.021***	0.005	-0.010	0.005
Supervisor support	-0.293***	0.027	-0.072**	0.024	-0.046	0.024
Co-worker support	-0.276***	0.040	-0.077**	0.035	-0.038	0.035
Physical demands	1.291***	0.167	0.484**	0.148	0.345*	0.148
Emotional demands	0.906***	0.050	0.345***	0.047	0.302***	0.047
Job insecurity	1.804***	0.237	0.304	0.211	0.202	0.211
Conflicts supervisor	2.079***	0.205	0.697***	0.184	0.600**	0.183
Conflicts co-worker	1.876***	0.236	0.634**	0.209	0.579**	0.208

Work characteristic	Women (<i>N</i> = 2311)					
	Model 1†		Model 2‡		Model 3§	
	B	S.E.	B	S.E.	B	S.E.
Psychological demands	0.095***	0.021	0.020	0.020	0.011	0.020
Decision latitude	-0.032**	0.011	0.0004	0.011	0.007	0.011
Supervisor support	-0.217***	0.052	-0.021	0.050	0.021	0.050
Co-worker support	-0.317***	0.075	-0.111	0.070	-0.097	0.070
Physical demands	0.666*	0.282	0.331	0.261	0.281	0.262
Emotional demands	0.502***	0.095	0.157	0.090	0.113	0.090
Job insecurity	1.100*	0.443	0.254	0.411	0.202	0.410
Conflicts supervisor	1.620**	0.476	0.196	0.449	0.189	0.453
Conflicts co-worker	1.261*	0.508	0.063	0.473	-0.078	0.480

† Adjusted for age, educational level, living alone, employment status and presence of disease.

‡ Adjusted for age, educational level, living alone, employment status, presence of disease and baseline GHQ score (continuous).

§ Adjusted for age, educational level, living alone, employment status, presence of disease, baseline GHQ score (continuous) and baseline CIS score (continuous).

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Because a simple incidence analysis ignores the issue that those close to the CIS cut-off and making only small changes will be counted as incident cases, we introduced the refinement that they also have to have an increase of a certain size. The size was determined by calculating the mean within person variance for baseline and follow-up CIS measurement (8 points). Then the delta CIS score, which is the follow-up CIS score minus the baseline CIS score, was calculated for all employees. Hence, those who crossed the predefined CIS cut-off of > 76 at follow-up and had a delta CIS ≤ 8 were excluded from the analysis. In a first step, we adjusted for age, educational level, living alone, employment status, and presence of disease. Since fatigue and psychological distress are fairly well associated, we adjusted in a second step for the continuous baseline GHQ-12 or CIS score, when subsequent fatigue or psychological distress was considered as dependent variable, respectively. Odds ratios (ORs) and their 95% confidence intervals (95%

CIs) were calculated for each psychosocial work characteristic.

RESULTS

Intercorrelations of psychosocial work characteristics

Table 1 shows the Pearson intercorrelations of all psychosocial work characteristics for men and women separately. In both genders, the highest correlation was observed between supervisor social support and conflicts with supervisor ($r = -0.37$, $N = 6394$, $P < 0.01$ in men; $r = -0.31$, $N = 2259$, $P < 0.01$ in women). Overall, psychosocial work characteristics were rather weakly correlated with each other.

Work characteristics at baseline predicting fatigue at follow-up

In men and women, the linear regression analyses of each psychosocial work characteristics separately showed that after adjustment for po-

Table 4. *Prospective associations between work characteristics and the onset of fatigue in men (N = 5036), adjusted for potential confounders and baseline GHQ score*

Work characteristic	OR [†]	95% CI	OR [‡]	95% CI
Psychological demands				
High	1.61	1.27–2.04	1.28	1.00–1.64
Medium	1.42	1.10–1.82	1.23	0.95–1.59
Low	1		1	
Decision latitude				
Low	1.87	1.46–2.40	1.59	1.23–2.06
Medium	0.91	0.70–1.17	0.88	0.68–1.14
High	1		1	
Supervisor social support				
Low	1.62	1.33–1.98	1.38	1.12–1.69
High	1		1	
Co-worker social support				
Low	1.57	1.29–1.93	1.45	1.18–1.78
High	1		1	
Physical demands				
Yes	1.54	1.20–1.98	1.32	1.02–1.72
No	1		1	
Emotional demands				
High	2.01	1.59–2.54	1.47	1.14–1.88
Low	1.23	0.96–1.57	1.12	0.87–1.44
No	1		1	
Conflicts supervisor				
Yes	1.60	1.18–2.17	1.20	0.87–1.65
No	1		1	
Conflicts co-worker				
Yes	1.49	1.05–2.11	1.17	0.81–1.68
No	1		1	
Job insecurity				
Yes	1.28	0.87–1.89	0.93	0.62–1.39
No	1		1	

[†] Adjusted for age, educational level, living alone, employment status and presence of disease.

[‡] Adjusted for age, educational level, living alone, employment status, presence of disease and baseline GHQ score (continuous).

tential confounding variables, all psychosocial work characteristics were significantly associated with fatigue (Table 2, Model 1). In men, when controlled for baseline CIS score, psychological, physical and emotional demands as well as conflicts with co-worker were related to higher CIS scores, whereas decision latitude was significantly associated with lower CIS scores (Model 2). Lower CIS scores were also related to the two original subscales of decision latitude, skill discretion and decision authority, though stronger with decision authority (specific data not shown). While most associations remained significant after additional adjustment for baseline GHQ score, the association between conflicts with co-worker and fatigue was explained away (Model 3). For job insecurity a negative association with fatigue was found after control for both baseline measures. Given the weak to modest intercorrelations among the predictors,

the analyses of all psychosocial work characteristics together, adjusted for potential confounding variables and the baseline measures, showed similar effects for the various work characteristics as the effects seen in the separate analyses (specific data not shown).

As shown in Table 2, among women only co-worker social support was significantly related to lower CIS scores after adjustment for baseline CIS score and also after additional adjustment for baseline GHQ score. The finding was confirmed when all psychosocial work characteristics were entered together (specific data not shown).

Work characteristics at baseline predicting psychological distress at follow-up

As presented in Table 3, in men and women each psychosocial work characteristic separately was significantly associated with psychological dis-

Table 5. *Prospective associations between work characteristics and the onset of fatigue in women (N = 1787), adjusted for potential confounders and baseline GHQ score*

Work characteristic	OR†	95% CI	OR‡	95% CI
Psychological demands				
High	1.65	1.16–2.37	1.57	1.09–2.26
Medium	1.26	0.87–1.82	1.19	0.82–1.73
Low	1		1	
Decision latitude				
Low	1.56	1.07–2.25	1.51	1.04–2.19
Medium	1.28	0.90–1.81	1.22	0.86–1.74
High	1		1	
Supervisor social support				
Low	1.26	0.94–1.69	1.17	0.86–1.58
High	1		1	
Co-worker social support				
Low	1.83	1.33–2.52	1.78	1.29–2.47
High	1		1	
Physical demands				
Yes	1.41	1.01–1.97	1.34	0.95–1.87
No	1		1	
Emotional demands				
High	1.15	0.82–1.62	1.04	0.73–1.48
Low	1.17	0.81–1.69	1.10	0.76–1.60
No	1		1	
Conflicts supervisor				
Yes	1.80	1.06–3.06	1.61	0.94–2.76
No	1		1	
Conflicts co-worker				
Yes	2.25	1.31–3.87	2.12	1.23–3.67
No	1		1	
Job insecurity				
Yes	1.42	0.83–2.42	1.33	0.77–2.28
No	1		1	

† Adjusted for age, educational level, living alone, employment status and presence of disease.

‡ Adjusted for age, educational level, living alone, employment status, presence of disease and baseline GHQ score (continuous).

tress (Model 1). In men, only job insecurity was no longer significant after adjustment for baseline GHQ score (Model 2). When we also controlled for baseline CIS score, psychological, physical and emotional demands as well as conflicts with co-worker and supervisor were still significantly related to higher GHQ scores, while decision authority (specific data not shown) was significantly associated with lower GHQ scores. When all psychosocial work characteristics were analysed together and adjusted for potential confounders as well as baseline measures, the predictive effects of psychosocial work characteristics were found to be similar to those obtained in the separate analyses (specific data not shown).

In women, all associations between the separate psychosocial work characteristics and psychological distress were weakened and no longer significant after control for baseline GHQ

score (Model 2). The analyses of all psychosocial work characteristics together confirmed the finding of the separate analyses (specific data not shown).

Work characteristics at baseline predicting fatigue caseness

In the supplementary logistic regression analysis 66 cases (53 men and 13 women) were excluded because of a delta CIS ≤ 8 , even though their follow-up score was above the cut-off. The cumulative incidence of fatigue during 1 year follow-up was 9.7% ($N = 492$) in men, and 13.5% ($N = 241$) in women. In both genders significant associations between psychosocial work characteristics and fatigue were found. As shown in Table 4, in men all psychosocial work characteristics, except job insecurity, were significantly associated with fatigue. Although the odds ratios were reduced in size after adjustment

Table 6. Prospective associations between work characteristics and the onset of psychological distress in men (N = 5243), adjusted for potential confounders and baseline CIS score

Work characteristic	OR†	95% CI	OR‡	95% CI
Psychological demands				
High	1.63	1.33–2.00	1.51	1.23–1.85
Medium	1.20	0.96–1.50	1.16	0.93–1.45
Low	1		1	
Decision latitude				
Low	1.43	1.15–1.78	1.14	0.90–1.43
Medium	0.89	0.72–1.10	0.82	0.66–1.02
High	1		1	
Supervisor social support				
Low	1.39	1.17–1.65	1.25	1.05–1.49
High	1		1	
Co-worker social support				
Low	1.38	1.15–1.65	1.25	1.04–1.49
High	1		1	
Physical demands				
Yes	1.21	0.96–1.53	1.05	0.83–1.34
No	1		1	
Emotional demands				
High	1.94	1.57–2.39	1.73	1.40–2.14
Low	1.33	1.08–1.63	1.23	1.00–1.52
No	1		1	
Conflicts supervisor				
Yes	1.93	1.48–2.52	1.75	1.34–2.30
No	1		1	
Conflicts co-worker				
Yes	1.49	1.08–2.06	1.36	0.98–1.89
No	1		1	
Job insecurity				
Yes	1.83	1.33–2.51	1.63	1.18–2.27
No	1		1	

† Adjusted for age, educational level, living alone, employment status and presence of disease.

‡ Adjusted for age, educational level, living alone, employment status, presence of disease and baseline CIS score (continuous).

for baseline GHQ score, the onset of fatigue was predicted by low decision latitude (OR = 1.59 95% confidence interval (1.23–2.06)), high emotional demands (OR = 1.47 (1.14–1.88)) and low social support at work. As regards the original subscales of decision latitude, low decision authority (OR = 1.73 (1.34–2.23)) was strongly predictive for the onset of fatigue, whereas low skill discretion was no longer related to fatigue (not shown). For conflicts with co-worker and supervisor the associations were explained away.

In women, the ORs for physical demands and conflicts with supervisor were reduced in size after control for baseline GHQ score and these characteristics were no longer related to the onset of fatigue (Table 5). Strong predictors for the onset of fatigue were conflicts with co-worker (OR = 2.12 (1.23–3.67)) and low co-worker social support (OR = 1.78 (1.29–2.47)).

High psychological demands and low decision latitude, in particular low decision authority (OR = 1.71 (1.18–2.49); not shown), were also predictive for the onset of fatigue.

Work characteristics at baseline predicting psychological distress caseness

The cumulative incidence of psychological distress during 1 year follow-up was 12.6% (N = 657) in men, and 18.2% (N = 321) in women. Table 6 shows that in men, except for physical demands, significant associations were found between psychosocial work characteristics and the onset of psychological distress. Of these, conflicts with supervisor (OR = 1.75 (1.34–2.30)), high emotional demands (OR = 1.73 (1.40–2.14)), job insecurity and high psychological demands were still predictive for the onset of psychological distress after adjustment for baseline CIS score, whereas the associations

Table 7. Prospective associations between work characteristics and the onset of psychological distress in women (N = 1785), adjusted for potential confounders and baseline CIS score

Work characteristic	OR†	95% CI	OR‡	95% CI
Psychological demands				
High	1.59	1.15–2.19	1.44	1.03–2.01
Medium	1.24	0.90–1.70	1.20	0.86–1.66
Low	1		1	
Decision latitude				
Low	1.01	0.73–1.41	0.88	0.62–1.24
Medium	0.90	0.66–1.23	0.85	0.62–1.17
High	1		1	
Supervisor social support				
Low	1.30	1.00–1.70	1.12	0.85–1.47
High	1		1	
Co-worker social support				
Low	1.40	1.05–1.89	1.31	0.97–1.78
High	1		1	
Physical demands				
Yes	1.26	0.93–1.72	1.18	0.86–1.62
No	1		1	
Emotional demands				
High	1.53	1.13–2.09	1.39	1.01–1.91
Low	1.49	1.07–2.07	1.45	1.04–2.04
No	1		1	
Conflicts supervisor				
Yes	1.10	0.60–2.02	0.99	0.53–1.83
No	1		1	
Conflicts co-worker				
Yes	1.37	0.76–2.46	1.20	0.66–2.18
No	1		1	
Job insecurity				
Yes	1.03	0.62–1.71	0.94	0.56–1.59
No	1		1	

† Adjusted for age, educational level, living alone, employment status and presence of disease.

‡ Adjusted for age, educational level, living alone, employment status, presence of disease and baseline CIS score (continuous).

for low decision latitude and conflicts with co-worker were explained away.

As presented in Table 7, in women low supervisor and co-worker social support were no longer associated with psychological distress when controlled for baseline CIS score. High psychological demands (OR = 1.44 (1.03–2.01)) and high emotional demands, however, were predictive for the onset of psychological distress.

DISCUSSION

This prospective, longitudinal study showed that psychosocial work characteristics were significant predictors for the onset of fatigue during 1 year follow-up in the working population. Psychological demands at work as well as physical and emotional demands increased the risk for future fatigue in men, whereas decision latitude in men and co-worker social support in

women were protective against future fatigue. As regards psychological distress, no association was found with decision latitude, while conflicts at work increased the risk of psychological distress in both genders, suggesting that work characteristics which predict fatigue may differ from those which predict psychological distress. The prospective associations between psychosocial work characteristics and either fatigue or psychological distress remained significant after adjustment for potential confounding factors and baseline measures of fatigue or psychological distress, strengthening our results which are based on self-reported data.

To our knowledge, this is the first time that psychosocial work characteristics have been analysed as determinants of future fatigue in the working population. Our results suggest predictive effects of a wide range of psychosocial work characteristics on fatigue in men and

women. Overall, given the weak to modest intercorrelations of the psychosocial work characteristics, the predictive effects of the separate psychosocial work characteristics were quite similar to those obtained from analyses when all psychosocial work characteristics were entered together.

We found clear differences between men and women regarding the effects of work characteristics on fatigue after the adjustment for baseline fatigue. Notably, co-worker social support had a strong protective effect on future fatigue in women. In men, psychological, emotional and physical demands were predictive of fatigue, compared to decision latitude which remained significantly associated with lower fatigue scores. Somewhat unexpectedly, also job insecurity was found to be protective against future fatigue, when controlled for baseline measures in men. We have to keep in mind, however, that job insecurity was measured at baseline, while the follow-up of fatigue was 1 year later. Therefore, it is possible that when the threat of losing the job was removed – after all, the employees were still working 1 year later – the employees high on job insecurity at baseline likely experienced a decline in insecurity, which was then associated with less fatigue at follow-up. Whether the observed gender differences with respect to the effects of psychosocial work characteristics on fatigue may be partly explained by differences in the structure of occupations and work characteristics for men and women (Lennon 1995) or by differences in the perception of work conditions requires further exploration.

Consistent evidence for predictive effects of psychosocial work characteristics on fatigue was found in the logistic regression analysis. The cut-off point for fatigue was empirically derived in a separate pilot study (Bültmann *et al.* 2000). Upon crossing the cut-off, an additional refinement of a minimum amount of increase was required, thereby excluding those who are close to the cut-off and make only a small change. Hence, we note that in our conservative strategy, the findings underline the strong protective effects of high social support at work in both genders, and suggest a strong impact of conflicts with co-workers in particular among women. Low decision latitude and high emotional demands were found to be strong predictive

factors of fatigue in men, even after the adjustment for baseline psychological distress, which did not drastically weaken the associations and therefore shows the robustness of our findings. Thus, good interpersonal relationships at work and high decision latitude, especially decision authority, are of particular importance, and may be relevant aspects that should be addressed in workplace interventions.

The pattern of associations between psychosocial work characteristics and psychological distress showed partly similar and partly distinct effects compared to fatigue. In men, similar effects were found for psychological, emotional and physical demands, whereas conflicts at work was an important predictor of future psychological distress, but not of fatigue. Moreover, there was no effect of decision latitude on psychological distress. We found no prospective associations between psychosocial work characteristics and psychological distress in women after adjustment for baseline distress. The results of the logistic regression analysis, however, suggest differential effects of high emotional demands on psychological distress, while low decision latitude and bad relationships at work increased the risk of fatigue. One reason that psychosocial work characteristics might have a common effect on fatigue and psychological distress is because the two measures are correlated. Our prospective results, however, suggest some differential effects in the aetiology of fatigue *versus* psychological distress, which lends weight to the notion of the existence of two different concepts.

With respect to the present study, several issues have to be acknowledged. First, an overall response rate of 45% at baseline was reasonable for a survey in the working population, though a potential biasing of the results related to a selective participation of employees cannot be ruled out. A non-response analysis, however, demonstrated that non-respondents were less likely to report fatigue and sickness absence, which may have resulted in a slight overestimation of the level of fatigue. Regarding the response at follow-up, we have to recognize that non-respondents reported higher fatigue levels at baseline than respondents, which may have resulted in a slight underestimation of the cumulative 1-year incidence of fatigue. Nevertheless, we would like to emphasize that the

response rate at follow-up was 80%, and that the response was not affected by selective non-response from different sectors, trades and companies participating in the Maastricht Cohort Study.

A second issue concerns the time span between the assessment of psychosocial work characteristics, which reflect the condition at baseline, and the follow-up of fatigue and psychological distress of 1 year. Where most work characteristics were assumed to be relatively stable, others, like social support, job insecurity and conflicts at work could have changed during follow-up, so that the associations between these work characteristics and either fatigue or psychological distress would be attenuated. Frese & Zapf (1988) extensively discussed of how work characteristics may affect ill-health in the course of time and presented different conceptual models. Moreover, they suggested that different outcomes of ill-health may follow different models. In order to clarify whether work characteristics have immediate, delayed or cumulative effects, to specify the impact of exposure changes on future fatigue and psychological distress, as well as to elucidate the time course of ill-health, repeated exposure and outcome assessments in a broader time-frame are required.

Following on this issue, the potential underlying effects of negative affectivity (NA) on the self-report nature of our measures (Watson & Clark, 1984) have to be recognized. It is argued that individuals high on NA may perceive their work environment more negatively, thereby creating spurious associations between work characteristics and the reports of adverse health outcomes, which are also influenced by NA. Other authors (Stansfeld *et al.* 1998, 1999) have reported that work characteristics, although reduced in magnitude, remained associated with health functioning and psychiatric disorder after controlling for NA. However, in longitudinal analyses which adjust for baseline values of the outcome variable, the possible influence of NA is reduced. In our study, while negative affectivity is not measured, we adjusted for either baseline fatigue or psychological distress, thereby controlling for the influence of NA on baseline values. Moreover, to demonstrate the distinctness of the concepts of fatigue and psychological distress we also controlled for the other baseline measure which may lead to an overcorrection.

Finally, the present study focuses primarily on psychosocial work characteristics as risk factors for the onset of fatigue and psychological distress, while a broader, multi-factorial aetiology of fatigue is emphasized in the literature (Lewis & Wessely, 1992). Thus, it is possible that other factors, such as work-family aspects (e.g. domestic load, leisure time activities) and individual characteristics (e.g. health behaviour, coping style), may play a role in the onset of fatigue and psychological distress. Although we have not yet examined these relationships, it seems unlikely that these factors would affect strongly the associations found here. Nevertheless, in our analyses the presence of disease at baseline was taken into account as a confounding variable, because it might influence the reporting of either psychosocial work characteristics or fatigue and psychological distress. The findings showed, however, that the associations between psychosocial work characteristics and either fatigue or psychological distress were independent of the presence of a disease.

In conclusion, the findings of this prospective study provide support for the predictive effects of psychosocial work characteristics on fatigue in the working population. These associations are independent of baseline fatigue. Moreover, the study supports differential effects of psychosocial work characteristics in the aetiology of fatigue *versus* psychological distress and suggests that they may operate in different ways for men and women. Given the considerable impact of fatigue and psychological distress on the individual worker, the employers and the society, these findings underline the need for interventions addressing the psychosocial work environment in order to prevent, or at least reduce, the risk of fatigue and psychological distress in the working population. However, future research should further elucidate the multi-factorial aetiology of fatigue and psychological distress, thereby focusing on the role of work-family factors and individual characteristics as well as their interplay with psychosocial work characteristics.

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